Risk Analysis of Aquatic Invasive Species in Lake Champlain

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Introduction

- Aquatic Invasive Species (AIS) can be ecologically and economically harmful

- There are currently 51 AIS in Lake Champlain

- Numerous additional species represent significant economic and ecological threats to the Lake

- A risk analysis will delineate where species might gain a foothold within Lake Champlain

- The risk maps will be used to estimate the economic costs associated with treatment options

- This information can be used to prioritize areas for intervention(s) as part of a lake-wide management strategy

Objectives

- Document life histories for fifteen AIS: Alewife, **Asian Clam**, **Eurasian Watermilfoil**, European Frogbit, **Fanwort**, *Hydrilla*, Japanese Knotweed, **New Zealand Mud Snail**, *Quagga Mussel*, **Round Goby**, **Salvinia**, Northern Snakehead, **Spiny Water Flea**, VHS, **Water Chestnut**

- Identify possible areas of infestation for ten AIS (In **bold** text above) using spatial analytic techniques

- Quantify economic impacts of three AIS by focusing on treatment costs (in ***bold italics*** text above)

- Identify best management practices to avoid /mitigate infestation

Methods (Cost)

- Per hectare treatment cost(s) attributed to AIS infestation in other waterbodies were identified through a literature review

- Treatment costs for Lake Champlain were estimated by multiplying per hectare costs by the area of risk

Image 1. Hydrilla caught on propeller.   Image 2. Quagga Mussel.   Image 3. Asian clam.

Methods (Maps)

- Habitat characteristics associated with the ten selected potential AIS were determined using life histories and a literature review

- Spatial data associated with habitat characteristics were used to classify and map the potential risk for infestation throughout the lake using Geographic Information Systems

- Data resources used in the analysis:
  - Temperature and pH data were obtained from the Lake Champlain Long-Term Water Quality and Biological Monitoring Program
  - Bathymetry data were obtained from Vermont Center for Geographic Information

- The data were queried to identify lake locations that met habitat preferences

- Query results were combined to derive predictive risk analysis maps for each species

Results (Maps)

- The total area for the aggregate high risk area of the ten selected AIS is approximately 22,462 hectares (Fig. 1)

- Invasive species are generalist, so they can live in a broad range of conditions (Fig. 2, 3,4)

- Additional AIS are likely to establish throughout the lake due to the compatibility with desirable habitat characteristics (Fig. 1)
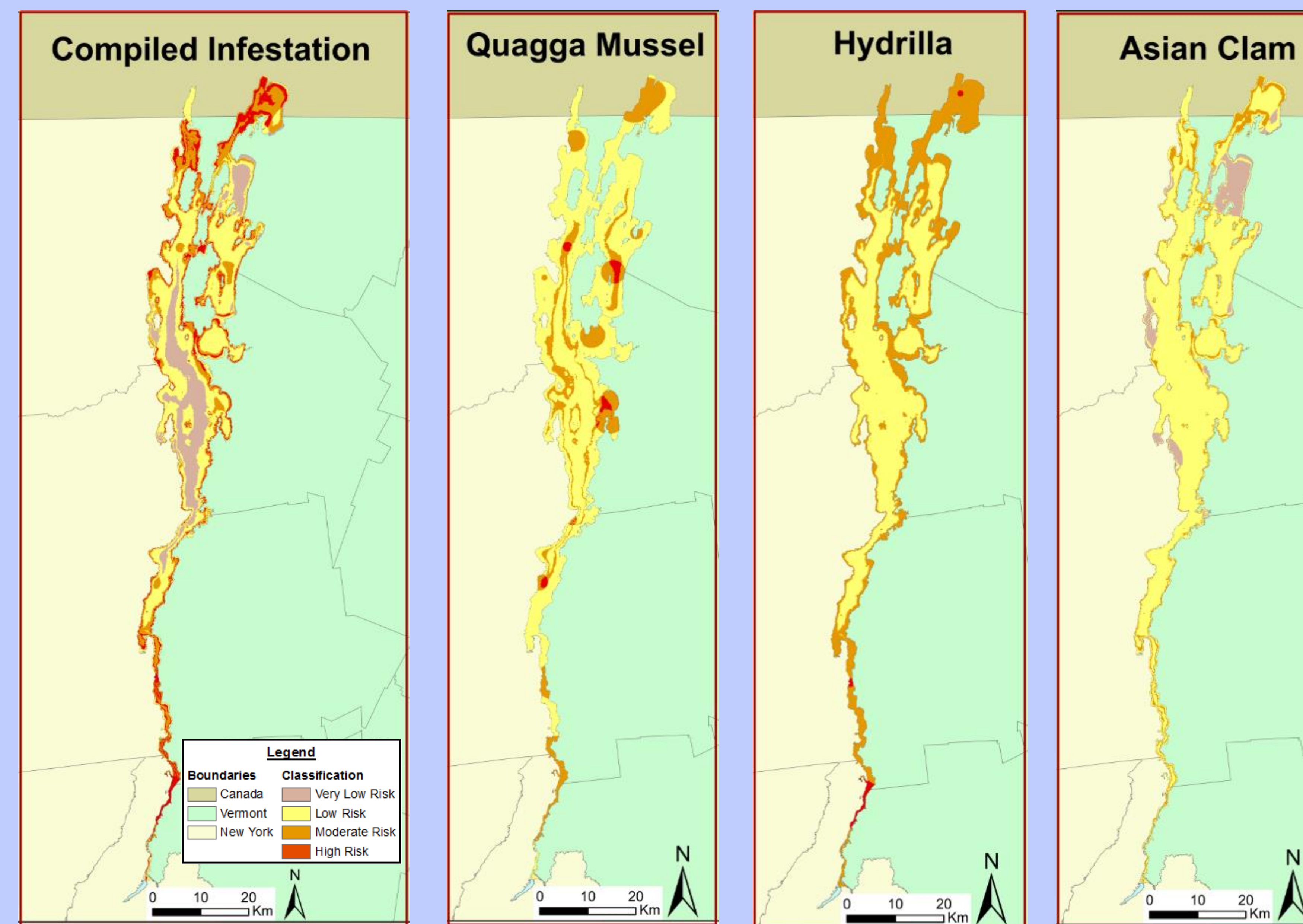

Figure 1. Map of aggregated potential infestations for all ten species.

Figure 2. Map of potential infestation for quagga mussel.

Figure 3. Map of potential infestation for hydrilla

Figure 4. Map of potential infestation for asian clam

Results (Cost)

- Treatment costs for three species are very high, and the economic burden for the whole lake will be costly (Table 1)

Table 1. Treatment costs associated with AIS

Species	Risk Class	Estimated Area (hectares)	Estimated Cost (dollars)
Asian Clam[a]	Very Low	10,721	2 billion
	Low	88,977	16.8 billion
	Moderate	13,988	2.6 billion
Hydrilla[b]	Low	61,209	6.7-10.1 billion
	Moderate	51,532	5.6-8.5 billion
	High	946	102 million-156 million
Quagga Mussel[c]	Low	85,915	6.5 billion
	Moderate	25,920	2 billion
	High	749	140 million

Discussion/Conclusion

- Findings of this research will help identify management practices to minimize the risk of invasion in Lake Champlain

- Generally speaking, the northern and southern segments of the Lake exhibit the highest risk for infestation, while quagga mussels should be of particular concern near St. Albans Bay

- Prevention and rapid response need to be a priority as they have the potential to realize the greatest amount of benefit with the least amount of cost

- This research is a pilot study for Lake Champlain. Future studies should:
  - Include data collection to fill in knowledge gaps about habitat characteristics and refine the risk assessment
  - Consider additional economic impacts such as tourism, recreational activities, property value, and industry

Acknowledgements
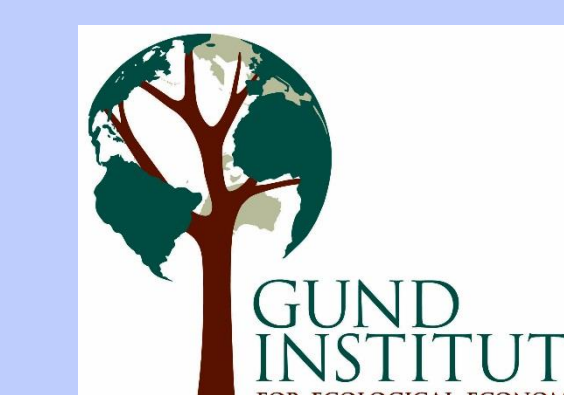
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References: a - Estimates from treatment of asian clam from Lake George ($76,500 per acre). Yellow Wood Associates. (2004). The Actual and Potential Economic Costs of Invasive Species in the Adirondacks. b – Estimates from treatment of hydrilla from Cayuga Inlet ($44,000 to $67,000 per acre). Yellow Wood Associates. (2004). The Actual and Potential Economic Costs of Invasive Species in the Adirondacks. c – Estimates from treatment of Zebra Mussels in Milbrook Quarry ($30,416.67 per acre). Summary of Attempted Control Measures for Zebra/Quagga Mussels in Open Waters .